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College education and the poor in China: documenting the hurdles to educational attainment and college matriculation

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Abstract Although universities have expanded in size, it is unclear whether the poor have benefited. If there are high returns to college education, then increasing access of the poor to college has important welfare implications. The objective of this paper is to document the rates of enrollment into college of the poor and to identify the hurdles to doing so. Relying on several sets of data, including a survey of college students from universities in three poor provinces in China, we have found that the college matriculation rate of the poor is substantially lower than students from non-poor families; the same is true for rural women and minorities. Clearly, there are barriers that are keeping the rural poor out. The paper also demonstrates that the real hurdles are not during the years of secondary schooling or at the time of admissions to college. The real impediments keeping the rural poor from pursuing a college education arise long before high school—as early as preschool and elementary school years—and are present throughout the entire schooling system.

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Going to college is increasingly an option for students in China. Fiscal allocations by the government into the university system have risen in the past 10 years, increasing by an annual real growth rate of over 13% between 1997 and 2006 (CNBS 2007a). The nation's total spending on tertiary education is ahead of many Asian developing countries, e.g., India and Indonesia, with similar age structures (UNESCO/OECD 2002). More than 800 new comprehensive universities (or colleges—the word we use to mean both universities and colleges in the rest of the paper) and professional tertiary schools were established. There are now nearly 2,000 colleges in China. Enrollment rates have also risen. Between 1997 and 2008, the number of college students increased from 3 to 17 million.

The demand for a college education is also high, reinforcing the supply-side shifts. Graduating from college is increasingly thought to be the most important criterion for employment in professional, managerial and other technically oriented jobs. As such, the return to a college degree is high, about 23.1% (Fleisher et al. 2007). Although there is a perception that getting a job after graduating from college is still difficult, in fact, almost all college students find a job within a year and their slope of earnings rise is steep (Cai et al. 2008).

College education is also important because it is so tightly linked to productivity, creating spillovers into the student's community in both China and the rest of the world. Growth rises in countries with higher rates of higher education (Barro 1991). As nations, including China,

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become richer, growth will depend on industries and services that are more sophisticated and complex, meaning more and more careers will require tertiary education. In addition, college education in Southeast Asia/Pacific and South Asia not only significantly benefits the individuals that pursue advanced degrees through the high returns to education, it can also have strong and transformative impacts on the communities from which the graduates have come (Gibson and McKenzie 2009; Bhagwati and Rao 1999). Boucher et al. (2005) also document that there are substantial "brain gains" in Latin America when poor communities are able to send one of their own to college. Finally, in the United States, it is also becoming increasingly evident that educated individuals are more likely to be more socially responsible, be sympathetic to philanthropy and subscribe to personal values—such as tolerance and an appreciation of differences among citizens of ethnicity and culture—that are crucial for the healthy function of modern, diverse society (Glaeser et al. 2006; Dee 2004).

Given these benefits to college education and since China's leaders have launched one of the greatest campaigns on rural development in the past 5 years (State Council 2006), it is natural to ask whether rural students, especially those from poor rural areas, are benefiting. Specifically, who is getting the opportunity to go to college and earn these high rates of return? Are the rural poor being systematically excluded? If they are, what are the barriers that are keeping them from having access to higher education? At what age (or level of schooling) are the barriers the most limiting?

In this paper, we seek to address this issue of educational access for the rural population, and we further seek to identify, if access is not good, why rural students are deciding not to go to college at such a high rate. We will pursue three specific objectives. First, we will try to measure enrollment rates in college of students from poor rural areas. Second, we examine whether there are any anti-poor biases in the *College Preparation and Admission* (CPA) Process that are keeping poor rural high school students from continuing their studies into college. The CPA Process is defined in the paper as all of the events that occur between the time a student has *already* made it into an academic high school and the time that he/she matriculates into college. Third, we are also interested in identifying what other factors are impeding the progress of poor, rural students—from the time *before* the student enters primary school until the point of time that he/she graduates from junior high and is able to enter academic high school (or decides to take another path).

Data

In this paper, we use two sets of our own survey data. The first survey covers a group of randomly selected high school students from the poor parts of Shaanxi province, one of China's poorest provinces. In the rest of the paper, this survey is called the *Academic High School Survey (*or the *AHS Survey)*. In order to identify the poor students, the initial step of the survey was to conduct a canvas survey in May 2007. At that time, the sample students were still in their second year of senior high school. In the canvas survey, eight poor counties in Shaanxi were randomly selected: Hengshan, Mizhi, Yanchang, Yichuan, Zhashui, Danfeng, Ziyang, and Ningshan. Altogether we sampled 10 senior high schools in the eight counties, one per county, except for the two counties with the largest populations (in which two sample schools were selected). The survey team randomly chose two classes of grade two (*gao-er*) per school. There were more than 50 students per class. The total sample size was 1,177.

The sample students filled out a survey instrument that collected information on several different aspects of each student's education experience and family life. We collected information each respondent's age and gender and his/her subject of study focus—either *Li-ke* (a science and engineering track student) or *Wen-ke* (a humanities and social science track student). We also asked each student to report the score that he/she achieved on the high school admissions examination. Another block of the survey collected information on the age of the parents, their level of educational attainment, occupation, migration status, their current location of residence (at home or away from home) and the value of the household's assets.

One of the main uses of the survey was to use it as a tool to collect information that could be used to find a set of students that was truly poor. We identified the truly poor students by using three pieces of information coming from the three independent survey efforts we executed in each school. The first piece of information came from a section of the student survey. Each student was asked to fill out a check list of the durable assets owned by his/her household. Once a value was attached to each asset (based on the national Household Income and Expenditure Survey which is organized and published by the China National Bureau of Statistics—CNBS 2007b), we had a single metric of the asset holdings of each student's household. The second piece of information came from the survey effort that was directed at the homeroom teacher. In a separate sit-down survey conducted at that same time that the student surveys were occurring, enumerators asked the homeroom teacher to provide a list of the 10 poorest students in his/her class. We obtained the last piece of information from a similar survey conducted with the director in charge of student affairs at each high school. Enumerators asked this respondent (in the same way that the homeroom teacher was asked) for an independent list of the 10 poorest students in each of the sample classes. These three pieces of

information were then used to identify 592 students in our sample (out of a total of 1,177 students) that were from poor rural families. Our discussion hereafter focuses mostly on the poor ($n_1 = 592$) and non-poor ($n_2 = 585$) sample high school students.

In order to collect information on our dependent variables, those associated with the CPA Process, we conducted a second round of surveys of our sample students and their homeroom teachers in August 2008. By this time, the sample students had already received their offer letters from colleges and knew whether they had been admitted to a tier one or tier two college. The data came from the homeroom teachers of the students and from the students themselves. From a survey instrument that included the names of all of their students (both poor and non-poor students), we asked each homeroom teacher to collect information on students, including each student's *gaokao* score, *zhiyuan* (the choices of college on his/her college application form) and the exact college into which they were able to enroll (if any). We also contacted all of the students themselves by phone and discovered whether or not each student had received an offer of admission and whether or not they were able to matriculate. If the students were able to matriculate, this meant that their family was able to pay a set of tuition and fees or, at the very least, make arrangements for payment at a later date.

Finally, during this time, we also collected information about the college and major to which the students chose to go as their first choice (on the *zhiyuan* form). We were most interested in getting the published CPA score cutoffs for the previous year, 2007, for each student's first choice. The CPA score cutoffs for each university (by major) were attained from a compilation published by *College Admission Magazine* in 2008 (which is a publication supported and authorized by the Division of Student Affairs, Ministry of Education). Having this information was useful since it is one of the most important piece of information that students use when deciding to what college/major they should apply.[1]

The second survey is actually a complete census of all entering freshman in 2008 into four universities—two nationally supported universities (Xi'an Jiaotong University and Sichuan University) and two provincially supported universities (Anhui University and Northwest University in Xi'an). These four universities are located in three poor provinces—Shaanxi, Sichuan, and Anhui. For clarity, we call this survey the *University Matriculation Survey*.

[1] Under the college/major choice system within the CEE in 2008 in Shaanxi province, students must list their preferred college/majors before knowing the year's cutoffs. Students rely on the previous year's cutoff information for a best estimate of what the cutoff's will be for current year.

In order to implement the University Matriculation Survey, the division head of the student affairs office in each university assigned a team to make sure that the survey form was distributed to each student at some point of time during the first week of the academic year. In this way, a set of survey forms was distributed to each *banzhuren,* which is the equivalent of a homeroom teacher in US high schools. The *banzhuren* were given directions on how to fill out the form. Students were told that the survey was voluntary. Students also were told that the survey was for research purposes only. The students returned the completed forms to the *banzhuren*, and the forms were returned to the research team by the end of the second week of September, the second week of the first term of all of the freshman students. The response rate was higher than 99%. In total, we surveyed 20,253 students.

The rural poor and college matriculation

The first step to understanding whether students from poor rural areas are being systematically excluded from college is to assess promotion rates from high school to college. At the national level, the rate of promotion of senior secondary school students from high school into tier one, two and three universities is around 35% (MOE 2006). This figure is calculated as the ratio of first-year college students (newly matriculating college students or *NMCS*) in 2005 to high school graduates (*HSG*) during the same year. The ratio is NMCS/HSG. The number that represents NMCS is composed of two parts—one part is first-year college students that matriculated directly out of high school, that is, they graduated from high school 2 months before starting college ($NMCS_1$), and those that graduated from high school at least 1 year earlier, but for some reason did not matriculate to college during the year in which they graduated ($NMCS_2$). The share of the total number of newly matriculating college students (NMCS) that are of the type $NMCS_2$ is around 10% (www.huayu.com). Thus, the rate of promotion of senior secondary school students from high school into tier one, two and three universities should be adjusted down by about 3–4 percentage points to 31% at the national level.

Although opportunities to go to college are increasing, the opportunities for different groups in China have unfolded unequally. Most poignantly, nearly 54% of senior high students living in three metropolitan province-level cites (Beijing, Tianjin, and Shanghai) attend first, second, or third tier colleges (CNBS 2007a). In 2007, of the 2,68,000 students that graduated from high school in these three municipalities, 1,44,000 were able to attend a first, second, or third tier college. This level (54%) is 23% higher than the national average (31%).

If better-off urban areas send their students to college at much higher rates, it stands to reason that poorer rural areas most likely are under-represented. In fact, it is widely surmised in the literature (although mostly without empirical evidence) that poor rural areas have been lagging in China's continuing drive to develop college education (China View 2009). Unfortunately, published statistical sources do not provide information on college enrollment rates by urban and rural (or by rich and poor).

Therefore, we need to rely on our own calculations. As the national average rate of promotion to college is, in effect, an average of urban and rural rates weighted by their respective proportion of the national graduating high school class, we can extract a rough estimate of the rural rate of promotion to college using the national statistic (31%) and our estimate of the urban rate (54%) from above. The formula we use is:

$$\begin{aligned}\text{National average rate of promotion to college} &= (\text{urban rate of promotion} \\ &\quad \times \%\text{senior high graduates that are urban}) \\ &\quad + (\text{rural rate of promotion} \\ &\quad \times \%\text{of senior high graduates that are rural})\end{aligned}$$

or

$$0.31 = 0.54 \times 40\% + \text{rural rate} \times 60\%.$$

From this calculation, we estimate that the rural rate of promotion from high school to college is 16%.

As it turns out, we can also estimate the rural rate directly from the AHS Survey. According to the survey data, only 20% of students from poor rural areas were promoted from high school to first, second, and third tier colleges. Assuming that promotion rates of rural students are similar in other poor provinces, it is clear to see that poor rural students are not getting equal access to college. While promotion rates of students in well-off urban areas are more than 20% higher than the national average, promotion rates of students from poor, rural areas are 11–15 percentage points lower than the national average.

However, just as the urban rate of promotion is a composite of the urban (not poor) and "urban–suburban" (more poor) rates, so must the rural rate of promotion be a composite of the rural (poor) and "rural–suburban" (less poor) rates. Rural poor areas also include some students from non-poor households. For this reason, both our indirect estimate (16%) and our direct estimate (20%) most likely overstate the rate that the poor in poor rural areas are being promoted to college.

The bias against poor, rural students can also be seen when looking at the data from the University Matriculation Survey. Since this survey only has information on those students that gained promotion into a university (and not on those students that did not matriculate), the strategy for making an assessment about whether or not there are biases against poor rural students must be different than when using the AHS Survey. To do so with this dataset, we first calculate a specific group's share (e.g., rural students) of enrollment in the sample colleges compared to the group's share in the population as a whole. If the share of a group (e.g., students from urban areas) exceeds its population share, we say this group has an "advantage," and if the share of a group is less than its population share, we say that there is some sort of bias restricting access of this group to college.

Most basically, according to our data from the University Matriculation Survey, we find that there is bias against rural students. The enrollment rates of students from urban areas and rural areas are almost even: 51% are from urban areas and 49% are from rural areas (Table 1, column 3, rows 2 and 3). However, the share of the 18- to 21-year-old rural cohort in the total (rural + urban) 18- to 21-year-old population (60%—CNBS 2007a, b, c, d) is larger than the share of students from rural areas. In other words, rural students matriculate at a lower rate than urban students. The share of rural university students is 11 percentage points lower than its population share. In fact, the gap is greater when using data on urbanization rates from Sichuan, Shaanxi, and Anhui provinces (the home provinces of the 4 universities in our sample). Using data from the three provinces only, the share of students in the universities is 18 percentage points smaller than the share of rural people in the overall population (67%).[2]

Following this approach, we see that there is even more of a bias against poor rural students (even more than rural students in general). According to our data, the share of sample students from poor rural areas is 9.5% (Table 1, column 5, row 2).[3] Drawing on data from the 2006 yearbook, we can see the share of population living in poor counties is 17% (CNBS 2006). Since according to the same data source, 88% of those in poor counties live in rural

[2] It is unclear if we should use population shares from the entire nation or just from the three provinces. If we had information on enrollment rates from the entire country (instead of only from four universities), we would of course use the national population shares. Unfortunately, we do not have a national representative sample. In contrast, if universities only recruited students from their own host provinces, then the right number to use would be those from the three provinces. However, in fact, universities do recruit students from the entire country. In fact, according to our data, 53% of the students (47% of rural students and 59% of urban students) in the four universities are from outside of their universities' host provinces. Consequently, it is unclear what is the right number to use. Because most of the rural students are recruited from within the province, in the rest of the paper, we use the population shares from the three provinces only—except where otherwise noted.

[3] Here, poor rural area refers to the rural areas in Nationally-designated Poor Counties, a designation bestowed on counties by the State Council. http://en.cpad.gov.cn/item/2004-05-24/50008.html.

Table 1 Enrollment rates of the rural poor into four sample universities, 2008

	All students in the sample (rural + urban)		Rural students from poor areas[a]	
	Number of students	Percent	Number of students	Percent
Freshmen from all four sample universities	20,253	100	n.a.	n.a.
Rural	10,031	49	1,937	9.5
Urban	10,222	51	n.a.	n.a.
Freshman from universities that have designations as:				
National universities	12,277	61	845	6.9
Provincial universities	7,976	39	1,092	14

Source Author's University Matriculation Survey

[a] Rural students from poor areas, meaning that statistics in these columns are generated for rural students that live in nationally designated poor counties

areas, this means that the population share of those in poor rural areas is 15% (0.88 × 0.17). From this, it is clear that there is a bias against these students; the share of students from poor rural areas is 5.5 percentage points lower than the population share.

Bias against rural girls and poor rural minorities

Using the University Matriculation Survey data, we can also calculate a specific group's share of enrollment in the sample colleges (e.g., rural female students). This share can also be used to form a ratio of group share in college compared to group share in the population as a whole. If the ratio is less than 1, it means this group is under-represented in the college education system. If the ratio is larger than 1, it means this group is overrepresented.

According to our analysis, there is some discrimination again women, but it is almost fully in the case of rural women. In the case of urban women and urban men, there is no real statistical difference. In the case of rural women, however, the ratio is statistically significant and less than one. In other words, while the population share of rural women is 47.8, the share of rural women in college is only 33.7, 14.1 percentage points less (Table 2, column 6, row 1–2).

The most under-represented group, however, are ethnic minorities. When comparing Han to non-Han, we can see that minorities (non-Han) are under-represented (Table 2,

Table 2 The number and percentage of freshmen from rural areas by ethnicity and by gender

	All (Male + Female)		Male		Female	
		%		%		%
All ethnicity						
Sample [A] (number of students)[a]	10,031	100.0	6,658	66.3	3373	33.7
Age 14–22 [B] (million persons)[b]	149	100.0	78	52.2	72	47.8
Ratio [A/B]		1.00		1.27		0.71
Han						
Sample [A] (number of students)[a]	9,617	95.9	6,372	63.5	3245	32.4
Age 14–22 [B] (million persons)[b]	134	89.4	70	46.7	64	42.7
Ratio [A/B]		1.07		1.36		0.76
Non-Han						
Sample [A] (number of students)[a]	414	4.1	286	2.8	128	1.3
Age 14–22 [B] (million persons)[b]	16	10.6	9	5.5	7	5.1
Ratio [A/B]		0.39		0.51		0.25

Source Sampled data are from the University Matriculation Survey; the data at the national level attained from "The Tabulation on Nationalities of 2000 Population Census of China (CNBS, 2003)

[a] The unit of observation in the sample is "number of students"

[b] This is rural population for the ages of 14–22 at the national level in 2008 (million persons). These figures are calculated by population between the ages of 6–14 in 2000. Here, we ignore the death rate of the population in this age cohort during 2000–2008, and thus, these figures could be overestimated

columns 1–2 and rows 7–9). Rural China's 14- to 22-year-old cohort is 89.4% Han. However, 95.9% of the students in the University Matriculation Survey were Han. This means, of course, that the representative ratios for non-Han are small. The ratio of minorities as a whole is 0.39.

These ratios are even smaller in the case of rural female minority students (Table 2, columns 5–6. row 7–9). For example, the representative ratio of rural minority female students is only 0.25. Clearly, the share of rural minority females who are able to attend one of the four sample colleges is around one-quarter of its population share.

In short, such findings demonstrate the low level of college matriculation of the poor in China. To the extent that this demonstrates the inequality in China's education system, it shows that China is following a path that was not taken in the past by other successful countries in the region that today are developed. For example, Vinod et al. (2000) shows that the USA has always had fairly equitable levels of education. Likewise, people in Japan and Korea have had relatively equal access to education in their nations. China, in being different in this dimension, may be facing challenges that these other countries were able to avoid.

Hurdles during secondary schooling

In this section, we seek to identify why it is that so few students from poor rural areas are in China's colleges. There are two possible sets of barriers. The first set includes the obstacles to the progress of students after they test into secondary school (or high school) and before the time that they officially matriculate into college. This section will focus on this set of obstructions, which we call "hurdles during secondary schooling." The second set of barriers, discussed in the next section of the paper, examines barriers that are regularly encountered by students in poor rural areas before they test into high school.

Hurdles during the high school years

Once students from poor rural families get into high school, there are two types of barriers that they could face—those that occur during the 3 years of high school and those that arise during the CPA Process. To examine these hurdles during the 3 years of high school, we examine two sets of indicators collected as part of the AHS Survey. First, we examine whether the grades of poor students are lower. Second, we examine whether the dropout rate of the non-poor is lower than that of the poor.

According to both measures (grades and dropout rates), it does not appear as if the barriers exist between the time students matriculate into high school and the time that students take the college admissions examination or gaokao. For example, the data on the standardized grades collected for the sample students from their first and second years of high school clearly show that the average math (65/100) and Chinese language scores (66/100) of students who are poor are similar to the average math (64/100) and Chinese language scores (67/100) of students who are non-poor, respectively. The results of test scores of the poor and non-poor are statistically indistinguishable.

There also is evidence that dropout rates of poor and non-poor high school students are statistically identical. According to our data, the dropout rate of poorer students is only slightly higher than for non-poor students. Between the end of the second year of high school and the end of the third year of high school, we found that 3.7% of poor students dropped out. At the same time, 2.1% of non-poor students dropped out. These two dropout rates were statistically the same due to high variance of both.

Barriers during the CPA Process

For our application, it is convenient to think of the CPA Process in 2008 in Shaanxi province as consisting of three steps. First, students take the college admissions examination. Second, after finishing the examination (but before knowing their exact score), students then fill out a college application form, called the *zhiyuan*. Finally, if their CEE scores are high enough, and their choice of college (which was chosen when filling in their *zhiyuan*) is strategically chosen (that is, the cutoff of the college for which the student filled in on their *zhiyuan* is not too high for their actual examination score), the students must have the financial resources to pay their tuition and fees, the final step before matriculating into college.

Using this three-step CPA Process, we rely on data from the AHS Survey to identify the barriers at each step. First, we will examine whether there is any evidence that the college admissions examination is biased against poor rural students. Given that those who write the examination are almost certainly more urban-focused in their lives, it could be that rural students are at a disadvantage when it comes to taking the examination. However, according to our data on CEE performance of poor and non-poor students, there is no evidence that there is any bias against poor students. Specifically, in seven out of the eight *Li-ke* classes, there were no statistical differences between the scores of poor students and the scores of non-poor students. In six out of seven *Wen-ke* classes, there were no statistical differences either. In other words, our data show that poor students appear to be performing as well on the CEE as non-poor students. Overall in *Li-ke* classes, the standardized score of poor students was 0.02 and the standardized score of non-poor students was −0.03 (demonstrating that the point estimates of the poor were actually a bit higher). Overall in

Wen-ke classes, the standardized score of the poor was 0.03 and the standardized score of the non-poor was −0.03 (also demonstrating the point estimate of the poor was higher than the non-poor).

The similarities in scores are also shown by graphing the distribution of the CEE scores for both poor and rich students. Figure 1, panel A demonstrates that poor *Li-ke* students have almost the exact distribution as non-poor *Li-ke* students. Likewise, Fig. 1, panel B demonstrates the same for *Wen-ke* students. The distributions are almost identical.

Using the same information on the college admissions examination scores of the students in conjunction with information about the scores from the high school entrance examinations (from 3 years before—that is, their *zhongkao* scores), there also is no evidence that poor students are falling behind during high school. The decomposition of college admissions examination scores by historical performance (using *zhongkao* scores as measures of historical performance) confirms the conclusion that there is no systemic difference between the poor and non-poor at this stage of the academic process (Tables 3, 4). We can more clearly show this by dividing poor and non-poor students into quartiles, according to their *zhongkao* scores. Using these breakdowns, we examine whether there is any change in performance. For the group of those in the upper quartile of *zhongkao* scores (regardless of whether they were in the *Li-ke* or *Wen-ke* tracks of study), the college admissions scores of the poor, on average, are not statistically different than those of the non-poor. The same is true in the other three quartile groups. This set of findings implies that after 3 years of high school study, the poor are not lagging behind the non-poor in terms of being competitive in the CPA Process. One interpretation of this finding is that students from poor families are performing as well on the *gaokao* as they did on the *zhongkao*.

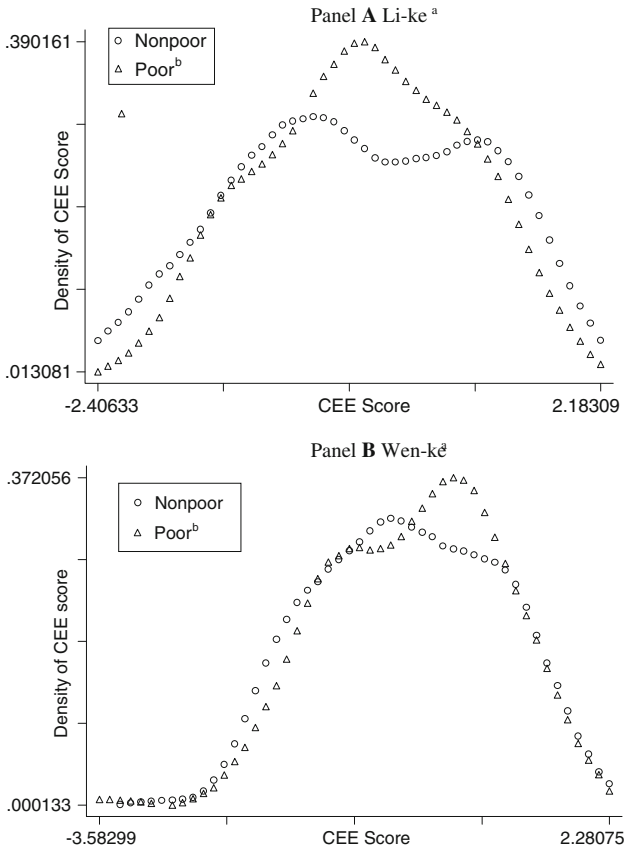

Fig. 1 Kernel density curves of CEE scores of the poor and non-poor students in Li-ke and Wen-ke track in Shaanxi Province, 2008. *Source* Authors' survey—Shaanxi Senior High School Survey. *Note* **a** Li-ke means that students are pursuing a science and engineering track of classes; Wen-ke means that students are pursuing a social science and humanities track of classes. **b** Poor means that statistics in these columns are generated for rural students that live in nationally designated poor counties

Finally, multivariate analysis supports the descriptive results. Table 5 presents the results of a regression seeking to explain the college admissions examination scores. The variable of interest, in this case, is the student's poverty status. In other words, we want to see whether, holding other things constant, the poverty status of a student is a significant correlate of his or her performance on the CEE.

To show this, in the regression analysis, we use two kinds of variables to proxy a student's poverty status. In one version of the regression, we use a simple dummy variable, where the variable is equal to 1 if the student is from a poor family (that is, a family with assets less than 7,600 yuan). We also use an alternative measure, the log of the family assets in value terms. However, since the college admissions examination score may also be influenced by other factors, such as the characteristics of the student, characteristics of the parents, and whether or not they are in the *Li-ke* or *Wen-ke* track of study, control variables also are included to control for these factors. When running these regressions, we find that neither poverty status nor the value of family's asset holdings affects a student's CEE scores, ceteris paribus (Table 5, row 2 and 3).

Are poor students making mistakes in filling out their zhiyuan forms?

Within several days of completing the college admissions examination in 2008, students in Shaanxi fill out a college choice form (called the *zhiyuan* form) and submit their top choices in each of the different tiers of colleges (tier one, tier two, and tier three) to a provincial education authority. In filling out their *zhiyuan* form, students are able to choose several colleges within each of the college tiers. After the CEE scores of the students are tallied, admission authorities then sort through the *zhiyuan* forms, matching students to colleges/majors according to their score ranking. At the

Table 3 Test of the mean difference of normalized college entrance examination scores for poor and non-poor students in *li-ke* track classes by the quartile ranking of each student's high school entrance examination (or *zhongkao*) scores in Shaanxi Province, 2008

	Poor[a]		Non-poor		Test of mean difference
	No. of obs.	Score[b]	No. of obs.	Score	Test stats: *p*-value
Quartile 1[c]	42	−0.94	37	−1.10	0.24
		(0.56)		(0.67)	
Quartile 2	45	−0.60	26	−0.46	0.50
		(0.69)		(0.95)	
Quartile 3	53	0.06	43	0.09	0.85
		(0.66)		(0.89)	
Quartile 4	100	0.67	52	0.86	0.14
		(0.73)		(0.74)	
Total	240		158		

Source Authors' survey—Shaanxi Senior High School Survey

[a] Statistics in these columns are generated for rural students that live in nationally designated poverty counties

[b] Standard deviations are in parentheses

[c] Quartiles are defined by ranking all students by their *zhongkao* scores and dividing them into four groups. Quartile 1 students have the lowest *zhongkao* scores; quartile 4 students have the highest *zhongkao* scores

* Means significant at 5%; ** means significant at 1%

Table 4 Test of the mean difference of normalized college entrance examination scores for poor and non-poor students in *wen-ke* track classes by the quartile ranking of each student's high school entrance examination (or *zhongkao*) scores in Shaanxi Province, 2008

	Poor[a]		Non-poor		Test of mean difference
	No. of obs.	Score[b]	No. of obs.	Score	Test stats: *p*-value
Quartile 1[c]	51	−0.49	51	−0.80	0.07
		(0.88)		(0.80)	
Quartile 2	53	−0.17	52	−0.25	0.59
		(0.83)		(0.74)	
Quartile 3	39	0.56	53	0.43	0.49
		(0.71)		(0.96)	
Quartile 4	23	0.75	27	0.95	0.40
		(1.08)		(0.64)	
Total	166		183		

Source Authors' survey—Shaanxi Senior High School Survey

[a] Statistics in these columns are generated for rural students that live in nationally designated poverty counties

[b] Standard deviations are in parentheses

[c] Quartiles are defined by ranking all students by their *zhongkao* scores and dividing them into four groups. Quartile 1 students have the lowest *zhongkao* scores; quartile 4 students have the highest *zhongkao* scores

* Means significant at 5%; ** means significant at 1%

end of the sorting, students are assigned to one and only one college.

Mistakes can be made by students in this process. The main source of the problem is that when students in Shaanxi in 2008 are filling out their *zhiyuan* form, they do not know what their actual college admissions score is (the examination does not get graded or returned to the student until about 3 weeks after the *zhiyuan* form is handed in). Another problem is that even if the student knew the actual score, he/she does not know in any given year what the minimum score cutoff will be for any given college/major. The minimum score that allows a student to enter any given college/major is determined by the demand for the college/major by students, the supply of positions for the college/major by colleges, and the distribution of the college admission examination in any given year. Therefore, when making a decision about to which college/major one should apply, students often rely on cutoff scores (by college/

Table 5 Regression results using ordinary least squares estimators of the impact of the poverty of a student on the student's college entrance examination score in Shaanxi Province, 2008 (dependent variable = normalized college entrance examination score)

Variables	Model 1		Model 2	
	Coef.	*t* ratio	Coef.	*t* ratio
Poverty				
Poverty indicator (if student is from poor rural area = 1)	0.00	(0.03)		
Log(assets)			−0.04	(1.16)
Student characteristics				
Female = 1	0.07	(1.12)	0.07	(1.15)
Li-ke track = 1	−0.25**	(3.90)	−0.26**	(3.99)
Zhongkao (high school examination) score	7.90**	(20.34)	7.87**	(20.30)
Father characteristics				
Education	0.01	(0.83)	0.01	(0.95)
Living at home, (1 = yes, 0 otherwise)	0.17*	(2.30)	0.16*	(2.22)
Migrant worker, (1 = yes, 0 otherwise)	0.05	(0.61)	0.03	(0.38)
Mother characteristics				
Education	−0.01	(0.87)	−0.01	(0.72)
Living at home (1 = yes, 0 otherwise)	−0.24*	(2.51)	−0.23*	(2.45)
Migrant worker (1 = yes, 0 otherwise)	−0.08	(0.81)	−0.08	(0.80)
Constant	−5.47**	(18.32)	−5.15**	(12.72)
No. of observations	708		708	
Adj. R^2	0.3857		0.3868	

Source Authors' survey—Shaanxi Senior High School Survey

* significant at 5%; ** significant at 1% *t* ratios in parentheses

major) from previous years that are published in a Ministry of Education-approved publication. The objective when filling out the *zhiyuan* is to put down as one's first choice the best college/major that one can get into, given one's CEE score. A successful strategy for filling in the *zhiyuan* form depends on good estimates of one's own actual score and good estimates of the cutoffs for the various college/majors that one is interested in.

To examine whether the poor make mistakes in estimating the college admission examination score (and/or the cutoff), we first calculate the differences between the student's actual examination score and the past cutoff score of their first choice for either the tier one or tier two college in each student's *zhiyuan* form. We call this measure the gaokao score-cutoff gap. In the analysis, for clarity, we only report the score-cutoff gaps for the first choice for the first (second) tier college choice for the students who were admitted into first (second) tier universities. If the score-cutoff gap is positive, then it means that the student chose a cutoff that was lower than his/her college admission examination score (or, for simplicity, underestimated the gaokao score). The consequences of underestimating, of course, is that had the student chosen a college/major with a higher cutoff (that often means the college/majors was higher quality), the student could have attended a better college or been admitted to a better major. If the score-cutoff gap is negative, we say that the student overestimated his/her college admissions score and this means that he/she was not admitted (on average) into the college/major that was his/her first choice. The student still ended up getting into a tier one (two) college, but it would mean that he/she would be allocated to a major that was second or third or fourth choice. In the analysis that follows, we report and compare the score-cutoff gaps for the poor and non-poor and do so for both *Li-ke* and *Wen-ke* separately.

The results indicate that, on average, both the poor and non-poor in the *Li-ke* tracks underestimated their CEE scores (Table 6, rows 1 and 2). The point estimate of the score-cutoff gap of poor tier one students (30) was higher than that of non-poor tier one students (25). The higher score-cutoff gap for the poor means that the poor were more conservative or were not as good at estimating their CEE scores as the non-poor. Tests comparing these point estimates, however, show that there is no difference statistically. In the case of tier two students, the poor (10) underestimate less than non-poor students (23) and the difference is statistically significant. However, in the case of both tier one and tier two *Wen-ke* track students, there also is no statistical difference between the score-cutoff gaps of poor and non-poor students.

Table 6 The CEE score-cutoff gaps for students matriculating into tier one and tier two colleges from Shaanxi Province, 2008, by income and academic track

	Poor[a]		Non-poor		Test of mean difference
	Tier one colleges	Tier two colleges	Tier one colleges	Tier two colleges	Test stats: *p*-value
Li-ke[b]					
Mean	30		25		0.61
Std. Dev.	(25.44)		(27.83)		
Mean		10		23	0.05*
Std. Dev.		(22.10)		(24.15)	
No.	16	36	16	20	
Wen-ke[b]					
Mean	−3.00		−13.80		0.83
Std. Dev.	(8.72)		(16.57)		
Mean		4.86		3.89	0.56
Std. Dev.		(26.06)		(22.65)	
No.	3	22	5	28	

The CEE score-cutoff gap is the difference between the actual CEE score and the past cutoff score of the first choice for either the tier one or tier two college on each student's *zhiyuan* form

Source Authors' survey—Shaanxi Senior High School Survey

[a] Statistics in the "poor" columns were generated for rural students from nationally designated poverty counties

[b] *Li-ke* indicates the science and engineering track; *Wen-ke* indicates the social science and humanities track

* means significant at 5%; ** means significant at 1%

Liquidity constraints and college matriculations

Although the expansion in college education has opened up more opportunities for students in China to go to college, it has not been free for students and their families. Among other things, it has come at the cost of soaring tuition and fees. Tuition costs rose by four times between 1997 and 2006, increasing from 1,620 yuan to 4,500 yuan per student per year (Yu 2008; Cui 2007). By 2005, the share of college funding from tuition and fees had increased to 31% (MOE 2006). And tuition is only about half of the cost of a college education (often less than half). Most college students spend between 10,000 and 12,000 yuan per year on tuition and fees, books and rooms and board (Cui 2007). This implies that in addition to overcoming the academic hurdle of getting into college, poorer families also have to face the fact that they have to pay for the higher levels of tuition and fees (at least for the first year of their college education). The expense of around 10,000 yuan equals 9.4 times of per capita income for a rural family that is living at China's poverty line—which was 1,067 yuan per capita in 2008 (Poverty Alleviation Office 2008). Are the families of poor college students in 2008 able to come up with the tuition and fees that they need to pay for their first year of tuition and fees? In other words, is there any evidence that there are liquidity constraints that are literally turning back poor rural students from the gates of the university after they have passed their college admissions examination and received an offer of admission.

Although in the late 1990s and early 2000s, there were many stories of students being admitted to college but not able to afford to attend (e.g., People's Daily 2003a), according to our survey, this is not true in 2008. In fact, 100% of the students that passed the CEE and were admitted to a tier one or tier two college ended up going to the college.

Although we are not making any statement about the impact on the financial status of the family of the poor student (indeed, there are many stories of the incredible burden that they bear—e.g., People Daily 2003b), there is no evidence that the liquidity constraint is posing an impermeable barrier at this point of the CPA Process. Of course, in assessing this result, it may not be so surprising. When a student, especially one that had already made it through the third year of high school, was able to test into college, the parents had already made up their mind and had already prepared some way to pay the tuition and fees—even if they had to borrow or liquidate their assets. Those families that had any doubts about being able to afford college most likely had already pulled their child out of school and had him/her enter the labor market.

Other barriers: from preschool to high school

China has made great achievements in rural education over the past decade—especially in compulsory education, which ends in China with grade 9. In the past 5 years, fiscal

input by the national government has made grades 1–9 almost free. This effort—and other factors—have contributed to making compulsory education universal. Almost all children between the ages of 7 and 12 are in school. Girls attend elementary and middle school at rates almost equal to boys (Hannum et al. 2011).

High costs of high school education

While there has been progress in promoting higher education—both high school and tertiary education—it is not because of reductions in tuition and fees. At the same time that tuition and fees began to be reduced for elementary school and junior high, they were being raised for high school and college. Although school costs are not trivial for middle-class urban parents, they are extraordinarily high for families in poor rural areas. While we know (from the discussion above) how high college tuition and fees are, in this section, we examine how high the tuition and fees are for high school.

According to a recent survey by the authors, the costs of high school tuition, room, board, and other fees in rural areas are also extremely high (Liu et al. 2009). On average, students pay around 2,200 yuan per year for tuition. High school students who are from remote villages and townships almost invariably have to live at school, which costs about 1,600 yuan. This means that 3 years of high school can cost a poor family nearly 12,000 yuan. For a family that is living at the poverty line, this means that it takes about 12 times of per capita annual income to pay for high school. When comparing the tuition of China's rural public high schools against the levels of tuition for rural public high schools in more than 40 other countries (Liu et al. 2009), it is clear that China is an extreme outlier. Only 20% of countries charge for high school at all; China is more than 60% higher than the average of the second, third, fourth and fifth ranked countries.

Despite these high expenses, many families in China—urban and rural, even parents of households from the poorest, most remote parts of China—would like to send their child to high school and college. The decision to pay out this amount of money, however, depends on an assessment of the benefits. Several factors make the decision to go to high school a difficult one to make. When a person decides to go to high school, the cost is significantly higher than the "out-of-pocket" expenses, since he/she is able to enter the workforce and earn a wage; the foregone earnings can be substantial. The wage that a student can earn after attending high school (if not continuing to university or to a technical training/professional school) is about the same as the wage he/she would earn if he/she entered the workforce after junior high (Li et al. 2006). Finally, the decision also depends on the probability that the student will pass the entrance examination, which is low.

Hence, although poor parents of bright children very much want their children to get the education that they never had, sending their child to high school becomes a very hard decision. As seen, it involves many trade-offs and a lot of uncertainty. Poor families (like all families) desire to maximize their household's lifetime income and want to improve the livelihood of their children. Even when it comes to educating their child, they must confront the cold realities of the economic calculus.

When a family does decide to send their child to high school and beyond, they often have to take extreme measures. Paying high school fees can require poor families to sell scarce assets (Liu et al. 2009). The family must often borrow from relatives, friends, and neighbors. Increasingly, families must rely on high-interest loans from local money lenders. All of this sacrifice (plus the foregone wages) is required for taking a course in which there is only a 1 in 5 (20%—see above) chance of success. Because of all of these factors, it is not surprising that high school enrollment rates in poor rural areas are so low.[4]

Other rural schooling shortcomings

Beyond the financial burdens of high school, Li et al. (2006) also implicitly show that one of the main problems underlying the lack of competitiveness of rural students is that they just cannot compete—especially at the time that they are trying to get into high school. Of course, as shown above, once in high school, poor rural students successfully compete head to head with their urban counterparts. However, at the conclusion of junior high school, all students that want to continue on with schooling—both rural and urban—must take a standardized examination (the *zhongkao*). To succeed, then, rural students must compete with the rising number of increasingly well-trained students from urban China. If they cannot compete, they are unable to continue into the academic high school track and, hence, are unable to enter the college and university system, which has been shown to have an extremely high rate of return (Cai et al. 2008).

If this is so, this means that there are other factors that underlie the low enrollment rates of rural students in high school in addition to high tuition. In fact, an examination of the entire school system prior to a student's entrance to high school shows that the there are huge disadvantages the students face in getting an education that will make them competitive at the high school level (and beyond).

[4] Compared to its neighbors in East Asia, China's high school attainment rates can clearly be counted as low. At the same time in their development (e.g., the 1930s or the 1950s), Japan had almost 100% of their student-aged population in high school. High school graduation rates were also high—indeed almost 100%—in South Korea in the 1970s and 1980s.

According to the literature and our own work, the disadvantages to rural students appear even before elementary school (Luo et al. 2009b). In China, preschool is a private activity and is only recently being regulated by the state. There is almost no investment by the government into preschools. Since all preschools are private, started by those entrepreneurial enough to organize the space and teaching material, tuition is charged for all students. Lunches and transportation are also the responsibility of parents. There are virtually no Head Start-like programs to help the poor in rural areas get a preschool education. Hence, poor parents may decide they will not send their children to preschool.

Is tuition a barrier to participation in preschool? To test this, we are currently running a randomized control trial in a county in Henan (Luo et al. 2009b). To carry out the experiment, we randomly selected 100 four-and-a-half-year-olds that lived in villages that did not attend preschool as 3- or 4-year-olds. Before the beginning of the new academic year, we offered to pay tuition and provide a stipend for board and transportation for half of the parents of the children (all randomly selected). The other half were offered nothing. When we returned to the villages for a follow-up survey in late September (1 month into the new academic term), 98% of the students who received the tuition waiver (and subsidy) were attending preschool. Only 18% of those who were not offered the tuition waiver were attending preschool. Clearly, finances matter.

Even if they could afford preschool, rural families may have no access to preschools. In a recent survey by the Chinese Academy of Sciences, it was found that in rural areas, less than 20% of villages have convenient access to preschools (Luo et al. 2009b). In poor areas, the share of villages drops to less than 7%. From a recent visit to a set of poor counties in Guizhou province, the anecdotal support for this statistic was striking: we did not find even one village with preschool facilities during the 2 weeks that we visited villages across five counties.

Even when preschools are available, the quality of facilities and teaching may be too low to matter, in terms of giving students the skills in learning and social behavior that are critical for the formal learning that starts in grade 1 of primary school. Nearly 80% of preschool teachers in rural areas have no formal training in teaching preschool children. In contrast, more than 80% of teachers in urban areas do. To keep costs down, the student-to-teacher ratio in rural preschools is more than 25:1, even though national standards suggest that teachers care for no more than 8 children.

Because of this, it is no wonder that our survey found such low preschool attendance rates of children in rural villages. According to our survey in 6 counties in 3 poor provinces (Shaanxi, Gansu, and Henan), only 20% of rural children between the ages of 3 and 6 were attending preschool. In cities, in contrast, almost all children do.

Measured levels of educational readiness are also low among rural, preschool age children, almost certainly due, in part, to the fact that so few children in rural areas go to preschool. Dr. Mujia Ou, an educational specialist centering her attention on measuring educational readiness of urban children, developed a multidimensional readiness test. The test is purported to measure cognitive ability, numeracy, literacy, social behavior, physical skills, and other skills that are thought to be important for children to have if they are to succeed in China's schools. The range of possible test scores is from 0 to 130. After administering the test to tens of thousands of urban children, Ou has fine-tuned the test to a normal distribution centered on 90. If a child obtains a score lower than 70, he/she is considered to not have the skills or abilities to go to school and succeed. In the course of Ou's testing, she found about 7% of China's urban students score lower than 70. She had never given the test to rural students.

In a prior study, we gave Ou's test to rural students (Luo et al. 2009b). In June and July 2008, we administered the test to more than 700 4-year-old students in 6 provinces. According to the findings, the scores of most rural 4-year-olds were very low. The mean of the distribution was only 64, 6 points below the level that Ou believed signaled being non-ready. Fully 64% of the 4-year-olds to whom we administered the test scored less than 70. If, as many educators believe, it is difficult for a child who enters elementary school unready to catch up, then our finding (that the readiness scores of poor rural students are distinctly lower than those of urban students) explains a lot of why educational attainment in rural China is so low. It also does not bode well for an economy that is going to rely only more, given the demographic trends, on a rural labor force to carry out the tasks that require relatively high levels of learning and skills.

The problems do not stop in preschool. While tuition is now free in elementary school, facilities have improved in rural areas and teacher salaries are consistently paid in full, there are still serious barriers to learning in China's elementary schools. One problem (beyond the general poor quality of teaching and weak curriculum—which are both being addressed to some degree by government programs) that has received scant attention is the low level of nutrition that still plagues many students in rural schools across vast regions of China. Although severe iron deficiency is only 5% in urban China, across all rural areas, around 25% of students suffer from anemia (Luo et al. 2009a). In the poorest schools, more than half of elementary children in poor rural areas are anemic. And, when students suffer from anemia, it is well known that the cognitive ability of children fall, their attention span wanes and, in general, they are less able to learn (Grantham-McGregor and Ani 2001; Nokes et al. 1998).

Surprisingly, despite these potential problems, little is known about either the incidence of anemia in different parts of China or of its source. There are two main sources of anemia—poor diet and parasitic infection. China's government meal programs do nothing to address this problem in poor areas (Luo et al. 2009b). According to data from more than 70 rural schools in Shaanxi that provide dining services, there is no meat, protein, or other multi-vitamin supplements in the regular diets of school children. In fact, there are no standards. And, while there is a lot of evidence that parasitic worms are still a problem, we can find almost no schools that recognize there is a problem. Fewer schools (almost none) take any action to deworm their children—even though the cost of deworming drugs is less than 30 cents per dose (in US currency). If there is so little attention to nutrition at home and school, it is no wonder that educational performance of rural students is so poor. It also means that it will be difficult for these students to catch up in the future. If a whole part of the workforce is unable to learn the skills that are needed in China's modernizing economy, this could be one real potential barrier to future growth and economic transformation.

There are many other problems. There are serious problems that have emerged associated with China's new shift toward the use of boarding schools (Luo et al. 2009a). Migrant schools—enrollment in which is growing much faster than any other segment of China's education system—is essentially ignored by government officials (Ma et al. 2009). China's curriculum has a series of well-known shortcomings (e.g., many subjects are taught by rote learning).

Addressing these problems will be a challenge for the government to face if it is going to try to produce a workforce that can meet the challenge of a higher productivity economy (Rozelle et al. 2008). If this cannot be done, it is possible that China's growth could be affected. If the economy continues to grow without including this segment of the labor force, China is planting the seeds for long run inequality and poverty. The social and political problems that could grow out of having a two-tiered society could be serious. The best strategy to propel China forward is almost certainly to attack the new educational challenges with as much effort, financial resources, and innovative programs as was used in the past to make grades 1–9 education almost universal and to improve the quality and availability of college and university education.

Conclusion

Opportunities to go to college and earn a degree have risen dramatically in China. Government investment into the college systems has skyrocketed; the size of universities has increased. With the rise in the opportunity to go to college, our results indicate that the participation of the poor in accessing the opportunity for a college education is lower than the students from non-poor families. According to our analysis, only 4% of students from poor rural areas are able to enter tier one, two or three universities. In some large metropolitan areas of China, nearly 50% of students matriculate into the tertiary education system. Clearly, there is something that is keeping the rural poor out.

So why is it that the rural poor are being excluded? We examine two broad general categories of barriers. According to our data from Shaanxi province, it does not appear that the any real barriers appear at the period of time between the final year of high school and the first year of college. There is no empirical evidence that the College Entrance Examine (CEE) is biased against the poor. Holding all other factors constant, the examination scores of poor students are virtually the same as the examination scores of non-poor students. Nor does the level of household liquidity appear to be constraining. Despite the high costs, virtually every poor student that is admitted to college is able to pay the fees and tuitions that are demanded upon matriculation and is able to enter college. Although there is some evidence that the nature of the CPA Process (in particular, the timing of the choice of the college and the timing of when students find out about whether or not they receive financial aid—any financial aid is awarded during the first year of college, well after when students must make their college choices) distorts the decisions of poorer students of what college to attend and what major to pursue (the poor systematically choose to go to normal universities and defense-related colleges more than the non-poor since the costs of these institutions are lower), the admissions rates between the poor and non-poor who take the CEE examination are statistically the same.

Therefore, the paper concludes that if the real barriers are not at the time of admissions to college, there must be something systematically keeping poor children from ever making it to the point where they take the CEE. In fact, a close reading of the literature and some of our own data demonstrate that the rural education system—in general—is putting rural children at a severe disadvantage at almost every point of the education process (low rates of enrollment into early childhood education; low-quality elementary schools; poor nutrition and low-quality boarding facilities; high costs of high school tuition; a migrant schooling system that is outside of the public education system). In conclusion, we believe that the real barriers keeping the poor from college education are being erected early in the education experience of the rural poor—as early as preschool and elementary school—and are present throughout the entire schooling system.

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